Amendments to the Specification

The paragraph starting at page 2, line 26 and ending at page 3, line 7 has been amended as follows.

Accordingly, in order to reduce the number of such suction recovery operations, several types of detection systems for detecting the presence of ink droplets to be discharged have been developed. Broadly speaking, these systems can be divided into three main types: those that rely on optical detection, those that involve thermal detection and those that use vibration detection. A brief description of each of these techniques follows.

The paragraph starting at page 6, line 24 and ending at page 7, line 9 has been amended as follows.

However, the detection method described in Japanese Patent Application No. 11-100494 does have drawbacks of its own. For example, if, during detection, material other than the ink droplets to be detected is present within the detection field or if there is a change in the convection of the air, the amount of energy in the electromagnetic waves present in the detection area will fluctuate, becoming noise during detection and possibly giving false readings. Moreover, even if no such problem as just described actually occurs, ~~nevertheless~~ detection sensitivity must be improved, by reducing the noise level so as to improve the S/N.

The paragraph starting at page 7, line 15 and ending at line 20 has been amended as follows.

For example, a liquid detection method, a liquid detection apparatus, and a printing apparatus using the liquid detection apparatus according to the present invention is capable of detecting ~~the~~ small size and small volume ~~of droplet~~ droplets with high sensitivity and high reliability.

The paragraph starting at page 9, line 25 and ending at page 10, line 7 has been amended as follows.

According to still another aspect of the present invention, preferably a printing apparatus according to the ~~above described~~ above-described liquid detection apparatus comprises: an inkjet printhead having an electrothermal transducer which generates heat energy to be applied to ink in order to discharge the ink by using the heat energy; and adjustment means for adjusting the temperature of the ink for detection of ink ~~droplet~~ droplets by the liquid detection apparatus by sending an electric current into the electrothermal transducer.

The paragraph starting at page 14, line 5 and ending at line 24 has been amended as follows.

In addition, a cap 20 that ~~function~~ functions as an ink receiving means is provided at the home position of the carriage 15. The cap 20 moves up and down as necessary. When moving up, the cap 20 contacts the printhead 5 so as to cover the nozzles of the printhead 5 in order to prevent ink from evaporating and protect the printhead from dirt, dust and the like. A pump provided inside the cap 20 sucks ink away from the ink discharge nozzles to return the printhead 5 to a proper working ink discharge condition. Further, a cleaning blade (not shown) is provided near the cap 20 and moves with the printhead 5 in order to wipe ink away from the ink discharge surface of the printhead 5. The action of the above-described pump and cleaning blade causes ink to be suctioned away from the ink discharge nozzles of the printhead 5 and causes ink adhered onto the ink discharge surface of the printhead 5 to be removed, in order to reset the printhead 5 to the proper working ink discharge condition. These operations are collectively called the "recovery operation".

The paragraph starting at page 15, line 9 and ending at line 26 has been amended as follows.

The printing paper P is fed from the direction of the bottom of the drawing toward the top, with the paper being curved horizontally by a feed roller ~~2~~ 4 and a paper guide 22 and sent in the direction of arrow G (sub-scanning direction). The feed roller ~~2~~ 4 and a discharge roller 6 are each driven by a conveyance motor 31 (not shown) and, as necessary, precisely convey the printing paper P in a sub-scanning direction in conjunction

with the reciprocal movement of the carriage 15. Additionally, spurs 23 are arrayed in the sub-scanning direction and are made of a water-repellant material, of which a blade-like peripheral part alone contacts the printing paper P. These spurs 23, which are disposed opposite the discharge roller 6, are positioned at set intervals in the sub-scanning direction along a rod 23a so as to guide the discharge of the printed paper P without affecting any still-unfixed images printed on the paper.

The paragraph starting at page 17, line 7 and ending at line 13 has been amended as follows.

The output from the infrared sensor 8a changes according to the infrared rays emitted from the discharged ink droplets ~~5a~~ 5c, so by detecting these changes it is possible to determine the presence or absence of discharged ink droplets ~~5a~~ 5c and the volume of the ink droplets thus passing through the field of detection of the infrared sensor 8a.

The paragraph starting at page 17, line 26 and ending at page 18, line 10 has been amended as follows.

Also, in the example shown in Fig. 2, a rotary gear 8b is provided at a position opposite the infrared sensor 8a, but within the detection field of the infrared sensor 8a. This rotary gear 8b is provided within the limited space inside the printing apparatus,

so the rotary gear, which ~~that~~ is one ~~part~~ of the compositional elements of the printing apparatus, is depicted as being disposed near the infrared sensor 8a. In such cases, a member 8c is provided at the front of the rotary gear 8b, so as to block infrared rays coming from the left of the rotary gear 8b toward the infrared sensor 8a.

The paragraph starting at page 19, line 23 and ending at page 20, line 3 has been amended as follows.

In Fig. 4, reference numeral 24 denotes a controller for controlling the overall apparatus. The controller 24 has a CPU 25, a ROM 26 for storing the control programs executed by the CPU 25 as well as a variety of data, ~~and~~ a RAM 27 used as a work area by the CPU 25 as it executes various processes and for temporarily holding data (such as, for example, printing data), and a clock 29.

The paragraph starting at page 21, line 8 and ending at line 18 has been amended as follows.

The embodiments described above ~~uses~~ use an appropriately positioned shield member to prevent intrusion of infrared ray noise when using an infrared sensor to detect the presence of discharged ink droplets in an inkjet printing apparatus. As described above, the shielding member may be provided in the incident direction of such infrared ray noise, or it may be placed so as to cover the entire detection field of the infrared sensor. As

a result, the present invention minimizes noise and provides improved discharged ink droplet detection.

The paragraph starting at page 21, line 20 and ending at line 24 has been amended as follows.

~~An example~~ Examples in which ink droplets discharged from a printhead are detected ~~has~~ have been described in the foregoing ~~embodiment~~ embodiments. In this embodiment, an example in which a small amount of ink from an ink tank is detected will be described.

The paragraph starting at page 21, line 25 and ending at page 22, line 1 has been amended as follows.

Fig. 5 shows the structure of a detector for detecting a small amount of ink discharged from an ink tank. As shown in Fig. 5, ink ~~3b~~ 3a is moved from an ink tank 3 containing ink via a tube 3b to the printhead 5.

The paragraph starting at page 23, line 7 and ending at line 15 has been amended as follows.

Note that, in the description of the above embodiments, a liquid droplet discharged from the printhead is ink, and the liquid stored in the ink tank is also ink. However, the liquid stored in the ink tank is not limited to ink. For example, the ink tank may store a ~~processed~~ processing liquid to be discharged onto a print medium so as to improve fixability and water repellency of a printed image or to improve its image quality.

The paragraph starting at page 23, line 25 and ending at page 24, line 21 has been amended as follows.

As the typical arrangement and principle of the inkjet printing method, one practiced by use of the basic principle disclosed in, for example, U.S. Patent Nos. 4,723,129 and 4,740,796 is preferable. The above system is applicable to either one of so-called ~~an~~ on-demand ~~type~~ and ~~a~~ continuous ~~type~~ types. Particularly, in the case of the on-demand type, the system is effective because, by applying at least one driving signal, which corresponds to printing information and gives a rapid temperature rise exceeding nucleate boiling, to each of electrothermal transducers arranged in correspondence with a sheet or liquid channels holding a liquid (ink), heat energy is generated by the electrothermal transducer to effect film boiling on the heat acting surface of the printhead, and consequently, a bubble can be formed in the liquid (ink) in one-to-one correspondence with the driving signal. By discharging the liquid (ink) through a discharge opening by growth and shrinkage of the bubble, at least one droplet is formed. If the driving signal is applied as a pulse signal, the growth and shrinkage of the bubble can be attained instantly

and adequately to achieve discharge of the liquid (ink) with ~~the~~ particularly high response characteristics.

The paragraph starting at page 25, line 20 and ending at line 27 has been amended as follows.

In addition, not only a cartridge type printhead in which an ink tank is integrally arranged on the printhead itself, but also an exchangeable chip type printhead, as described in the above embodiments, which can be electrically connected to the apparatus main unit and can receive ~~an~~ ink from the apparatus main unit upon being mounted on the apparatus main unit, can be applicable to the present invention.

The paragraph starting at page 26, line 1 and ending at line 12 has been amended as follows.

It is preferable to add recovery means for the printhead, preliminary auxiliary means, and the like ~~provided as~~ to an arrangement of the printer of the present invention since the printing operation can be further stabilized. Examples of such means include, for the printhead, capping means, cleaning means, pressurization or suction means, and preliminary heating means using electrothermal transducers, another heating element, or a combination thereof. It is also effective for stable printing to provide a preliminary discharge mode which performs discharge independently of printing.

The paragraph starting at page 27, line 16 and ending at line 22 has been amended as follows.

In this case, ink may be situated opposite electrothermal transducers while being held in a liquid or solid state in recess portions of a porous sheet or ~~through holes~~ through-holes, as described in Japanese Patent Publication Laid-Open No. 54-56847 or 60-71260. In the present invention, the above-mentioned film boiling method is most effective for the above-mentioned inks.

The paragraph starting at page 28, line 3 and ending at line 7 has been amended as follows.

The present invention can be applied to a system constituted by a plurality of devices (e.g., a host computer, an interface device, a reader, and a printer), or to an apparatus comprising a single device (e.g., a copying ~~machine, and~~ machine or a facsimile apparatus).